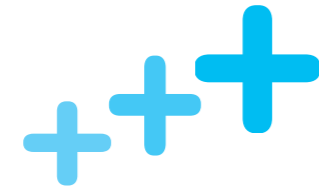
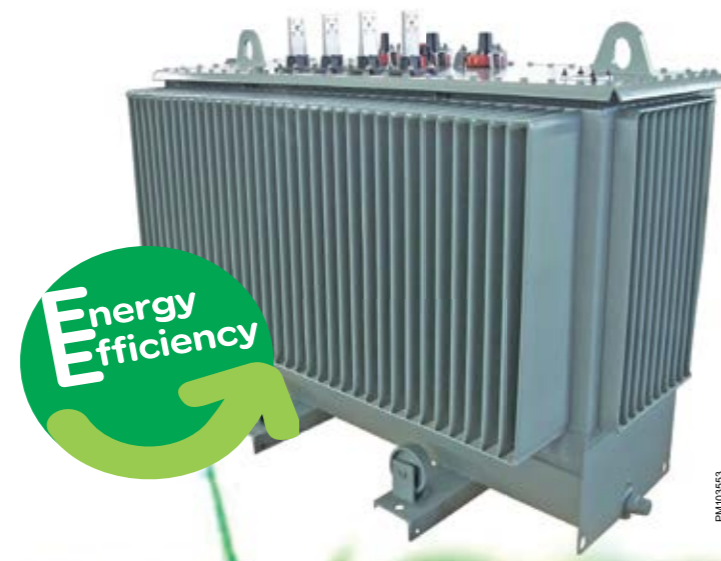


Customer Benefits



- ✓ **Energy efficiency**
Reduce no-load losses
- ✓ **Environmentally friendly**
Lower CO₂ emissions
- ✓ **Safety Assurance**
Full range Short Circuit withstand certified
- ✓ **Economically optimized**
Improve Total Cost of Ownership



“Switching to high-efficiency transformers will bring significant economic and environmental benefits”

Make the most of your energySM

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NRJED113447EN

As standards, specifications and designs change from time to time, please ask for confirmation of the information given in this publication.

Design: Schneider Electric Industries SAS
Photos: Schneider Electric Industries SAS

Minera HE+

Ultra High Efficiency Amorphous
Distribution Transformers
Up to 1600kVA and 36kV, 50/60Hz



Schneider
Electric

> What is the amorphous core technology ?

Amorphous metal is a solid metallic material with high magnetic conductivity that provides energy saving performance. The metal atoms are disordered and arranged in non-crystal way. Amorphous metal is different from conventional steel because is easier to be magnetized and de-magnetized. Amorphous metal sheet is 0.02 mm thick, which is about 1/10 of conventional silicon steel.

Advantages of amorphous metal magnetic core

- > **Reduction of magnetizing current**
- > **Lower temperature rise of core**
- > **Low-loss, especially no-load losses divided by 3 than conventional steel**
- > **Lower greenhouse emissions.**



“Losses can be reduced by using the amorphous metal for magnetic core”

Comparison of amorphous and conventional silicon steel (GOES)

Core raw material	GOES	Amorphous
Specific losses at 1.3 T, 50 Hz	0.4 ... 0.7 W/kg	0.2 W/kg
Saturation	> 2.0 T	~1.6 T
Thickness	0.2 ... 0.35 mm	0.02 ... 0.025 mm
Machinability	easy	complicated
Brittleness	no	yes
Dynamic stress withstand	low constraint	critical
Type of core		
Stack	yes	no
Wound	yes	yes
Shape of core (cross section)		
Round / oval	yes	no
Rectangular	yes	yes

> Transformer Life-Cycle Cost (Total Cost of Ownership)

Life-cycle cost (or total cost of ownership) is a method that considers not only the initial purchase price but also the comparative operating costs. Since the operating cost of a transformer, during its life span, maybe many times its initial price, the only fair comparison with competing models must take operating cost into account.

A transformer which has a low life-cycle cost is more cost efficient, since it requires lower overall power consumption, during its life span.

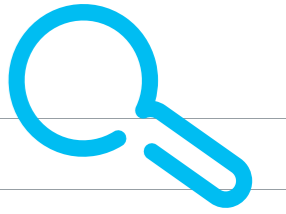
Example : Total Owning Cost of a 630 kVA Transformer (Ck Level)
Application : Renewable Energy Market

Combination of losses / Applications	Standard losses / C ₀ C _k	Amorphous / A ₀ +C _k	Amorphous Benefits	
			PV Park	Wind Park
Total Losses P0+Pk	7360 W	6810 W	Saving of 550 W/h at 45% Load	
Purchase Price *	8300 €	15300 €	Extra value of 7000 €	
Energy Price			0.55 €/kW	0.35 €/kW
Yearly Cost Saving **			2650 €/Year	1686 €/Year
Payback			3.0 Years	5.1 Years

(*) Basic purchase price - Not contractual and has to be considered as an example only

(**) Yearly cost saving (€/year) = Losses Saved * Energy price * 24 hours * 365 days

> Technical Characteristics

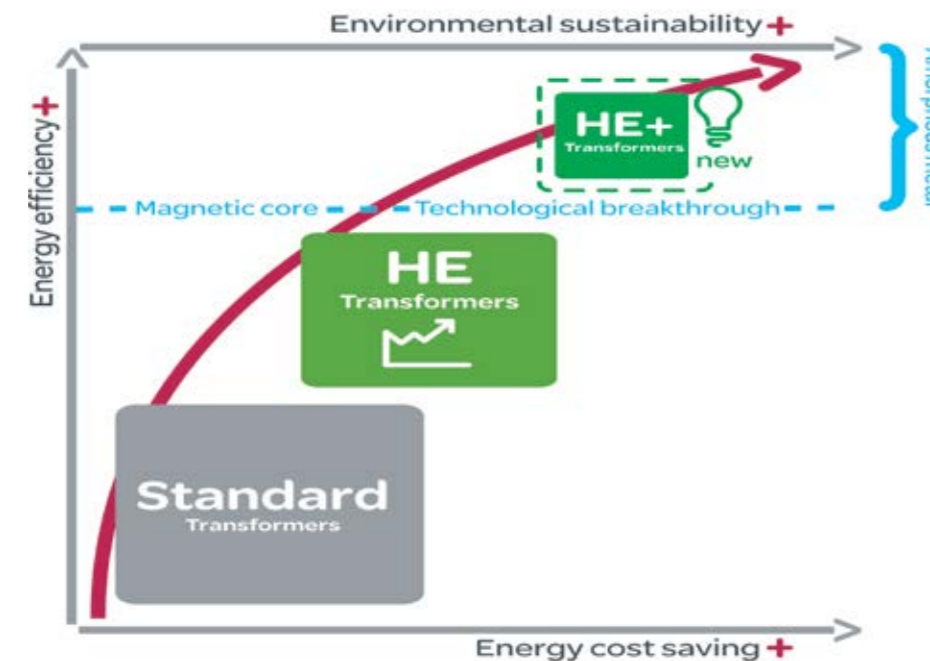


Oil-immersed distribution transformers	Hermetically sealed (without conservator) or with conservator
Manufacturing Standards	IEC 60076-1, EN 50464-1, others on request
Rated power	Up to 1600 kVA (others rated powers on request)
Insulation level	According to IEC U _m =1.1, 3.6, 7.2, 12, 17.5, 24, 36 kV
Phases	3-phase (single phase is applicable on request)
Losses (P ₀ ,P _k)	No load losses (P ₀): A0+, A0++, specific losses on request Load losses (P _k): From A _k to C _k (EN 50464-1 Standard), specific losses on request
Tappings	± 2.5 % - 5 Positions (or different range on request)
Voltage regulations	With off-circuit tap changer (regulation with on-load tap changer on request)
Short circuit impedance	U _k =4 % for P ≤ 630 kVA and U _M ≤24 kV U _k =4 or 4.5 % for P≤630 kVA and U _M =36 kV U _k =6 % for P > 630 kVA
Rated frequency	50 Hz (60 Hz on request)
Vector groups	Yzn recommended up to 50 kVA with U _M ≤24 kV Yzn recommended up to 100 kVA with U _M =36 kV Dyn11 (other vector group according to IEC Standards, on request)
Material thermal class insulation	According to IEC 60085 class A
Temperature rise	Average winding temperature rise: 65 K Top oil temperature rise: 60 K with ambient temperature in accordance with IEC 60076-1. The temperature of the cooling air should not exceed: <ul style="list-style-type: none"> • 20°C yearly average • 30°C monthly average of the hottest month • 40°C at any time Other ambient temperatures, winding and oil temperature shall be adapted.
Type of cooling	ONAN (Oil Natural Air Natural), KNAN, other upon request
Dielectric liquid	Mineral oil according to IEC 60296 Standard (on request: vegetable oil, synthetic ester)
Short circuit withstand	The transformers are designed to withstand the thermal and the dynamic effects resulting from a secondary short-circuit in accordance with IEC 60076-5.
Sound level	The measurement (A-weighted sound pressure L _{pA}) and the calculation of sound level (A-weighted sound level L _{wA}) are done in accordance with IEC 60076-10. The sound level requirements are in accordance with national standards
Installations	Indoor and/or outdoor
HV & LV terminals	HV terminals: plug-in or porcelain bushings LV terminals: busbars or porcelain bushings On request: cable boxes according to client/manufacturer standard or norm requirements (e.g BS)
Accessories	• Standard: lifting lugs, earthing terminal, name and rating plate, oil filling plug, off circuit tap changer, bi-directional rollers if applicable (out of scope hanging pole transformer) On request: pad lock/locking device for HV plug-in bushings and/or tap changer, protective relay (DMCR®, DGPT2®, RIS®,...), oil level indicator, oil thermometer, pressure relief device, filling valve, drain valve, winding temperature indicator, etc. Accessories for conservator: dehydrating breather, buchholz relay, drain plug, oil level indicator, etc

> Why is Minera HE+ transformer value for money ?

Schneider Electric provides a full range of energy efficient solutions to suit your exact needs. In addition to the existing high efficiency transformers Minera HE, Schneider Electric offers a new technology product range, amorphous core transformers **Minera HE+** which even higher energy savings.

Minera HE+ is an ultra high efficiency amorphous transformer which is more economical than “standard efficiency” transformer, as it consumes 70% to 80% less energy than conventional silicon steel transformers.



> Minera HE+ Short Circuit withstand

To ensure high level of quality and safety, Schneider Electric's **Minera HE+** transformers have successfully passed short circuit, dielectric and lightning impulse withstand tests.

The purposes of a short circuit test are :

- **Simulate**
A three-phase external Short Circuit fault event
- **Verify**
Ability to withstand very high short circuit current & mechanical stress
- **Minimize**
Safety hazard in case of failure
- **Eliminate**
Potential sources for damage
- **Validate**
Fully compliance with IEC 60076 standard.

Certified by accredited external laboratories

Minera HE+ is certified for short-circuit withstand according to the IEC 60076 standard and the requirements of eRDF company. Short-circuit tests on **Minera HE+** have demonstrated that maximum variation of reactance values, after the short circuit test, were **1.03%** for 630 kVA and 1250 kVA transformers.

